Science on the Hill: What cosmology tells us about quantum mechanics

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by Mark Paris

In physics' pursuit of ever-more-complete and detailed descriptions of our universe, we're always on the lookout for new tools.

Cosmology, the study of the universe at gargantuan distances, has recently become good enough to test our understanding of quantum mechanics, which describes minuscule, subatomic systems. A possibly surprising consequence is that quantum mechanics, in turn, helps cosmologists understand observations of the vastness of space, including those soon to be made with forthcoming "extremely large" telescopes.

Bringing the very small and the very large together using newly available, precise cosmological tools potentially allows physicists to better understand the building blocks of nature — and to probe what lies beyond our current knowledge of them.

Let's start with a crash course in cosmology. A few seconds after the Big Bang created the universe 13.8 billion years ago, the universe — the totality of everything — was a thick, 10-billion-degree cosmic "soup" of subatomic particles so energetic they refused to bind together. All that energy forced the universe outward, expanding and cooling the soup and generating the first light nuclei — the interiors of hydrogen, helium,and lithium atoms.

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